IDENTIFYING THE RELATIVE IMPORTANCE OF FACTORS AFFECTING QUALITY IN THE JORDANIAN HOUSING SECTOR

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DEDICATION

I would like to dedicate this work to my mother, who taught me the value of education. I’m deeply indebted to her for her continued support, without her I would not have achieved academic success.

I am eternally grateful for my husband, Wesam, for his constant love and strength throughout the years. Without him, and his ability to raise my spirits when I was most discouraged, I could never made it this far.

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Description	**Abbreviations**
Jordan Construction Contractors Association	JCCA
Jordanian Dinars	JOD
Jordanian Engineering Association	JEA
Mean	μ
Ministry of Industry and Trade	MIT
Significance Level	α
Standard Deviation	S.D
Statistical Significance of Leven's Test	p
Variance	σ

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Identifying the Relative Importance of Factors Affecting Quality in the Jordanian Housing Sector

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ABSTRACT

The aim of this study is to identify the relative importance of factors affecting quality in the Jordanian housing sector. Great expenditures of time, money and resources are wasted each year due to inefficient or non-existent quality levels. Therefore, this study attempts to understand the quality factors and their relative importance in the Jordanian housing sector.

Exploratory methodology is applied to achieve the research aim and objectives. Firstly, thirteen factors affecting quality in the Jordanian housing sector were identified based on exploring and analysing the previous research. Secondly, a survey of 328 questionnaires was designed and data was collected by structured personal interviews within two months among contractors and architects. Following that, *t*-test was used to determine the degree of agreement from the view point of the respondents of contractors and architects regarding the importance of factors.

The findings of this study suggest that contractors and architects combined agreed that the highest three factors affecting quality are: Human Resource Management, Customer Satisfaction, and Construction Specific Factors. The findings also confirm that Strategic

planning, Continuous improvement, Resources is the lowest important factors, which need more improvements and awareness in the industry.

This study provides a key contribution to the quality field, and recommendations are addressed to the industry. Theoretical contribution is made in this research by highlighting a conceptual framework for quality factors. This framework consists of 13 factors, which are the most relative factors to the housing sector in the Middle East, especially Jordan. Recommendations are suggested to the construction companies; which should focus on the highest factors and catch up with their lowest important factors in order to maintain a balanced and integrated quality approach and follow for example; U.S.A, Singapore and U.K experience in dealing with quality which have used quality successfully.

CHAPTER ONE
INTRODUCTION

This study aims to identify the relative importance of factors affecting quality in the Jordanian housing sector. This chapter highlights the research background and the problems that give rise to this study. It addresses the research aim and objectives and presents the research importance and contributions. Finally, the organization of the research is shown.

1.1 PREFACE

Top managers have recognized the need for applying quality philosophies to achieve high performance levels in products and processes and to face the challenges of new global competition. Moreover, Jung and Wang (2006), Burati and Oswaled (1993) and Lam and Thomas (2006) have expressed quality as a journey, not a destination which is a broad term and consists of various components and procedures. It is also defined as a management philosophy that has been entered into an area which has been receiving a growing amount of attention in the last two decades.

In recent years, there has been increased interest within the construction management community in exploring possibilities for applying knowledge gained from manufacturing and other industrial sectors to the problems of managing the construction process. Since, in most countries, it represents a significant part of the Gross Domestic Product (GDP) and employment.

Drawing from above, this has seen a greater openness to more general management thinking and an enthusiasm for recent management developments,

including those encapsulated within programmes such as quality management, business process re-engineering , continuous improvement, benchmarking, lean production, strategic partnering and supply chain management, reflecting this shift in, which explicitly sets out to explore construction as a manufacturing process and the possibilities of learning (Santos and Powell,1995). One form of operation management practices is quality management, which has received a growing amount of attention in the last two decades. the organizations looks for a high level of effectiveness across all functions and process and chooses a quality management as a strategy to stay in the business and introducing the culture of continuous improvement among managers and workforce.

Abdel Salam and Gad (2009) have argued that the types of construction projects require very high scale of quality. Unfortunately, contractors rarely have a realistic idea of how much profit they are losing by not attaining an acceptable level of quality. Turk (2006) stated that quality may sometimes be ignored in the construction industry in order to cut the costs and shorten the project duration. However, it is believed that the benefits of higher customer satisfaction, better quality products, and higher market share are often obtained following the adoption of quality by construction companies (Pheng and Teo, 2004).

Recent events in the Middle East region coupled with restructuring of economics, emergence of the world trade organization and the rising price of oil are expected to yield an unprecedented growth in construction activities especially in tourism and residential sectors. Consequently, a huge number of large scale projects are currently under construction or in planning and contract awarding phase (Attar and Sweis, 2010).

Recently, the Jordanian construction industry has experienced growth during the boom that occurred in the last decade encouraging investment in the construction sector and raising the importance of deploying management philosophies advancement to this industrial segment .In the context of quality in Jordan, the effects of quality on an organization business are numerous and have improved the productivity of design and project management and now become vital to construction business to survive and have a competitive edge (Sweis et al.,2008). Therefore, this study attempts to contribute in solving these challenges, where the main aim of this study is to identify the relative importance of factors affecting quality in the Jordanian housing sector.

1.2 The Research Problem

Due to the dearth of researches focusing on quality in construction projects in Jordan; the aim of this study is to identify factors affecting quality in the Jordanian housing sector and their relative importance. The main problem motivating this research is that construction industry in developing countries such as Jordan has limited understanding of quality factors and is unable to manage a high performance in the construction industry. Construction client are not satisfied with the performance achieved on many of their projects. Retrospectively, there is a need to recommend and inform private and government sectors working in this industry by understanding this issue. The novel focus is to identify the factors affecting quality and their relative importance in the industry. Specifically, the study addresses the following research questions:

1- How quality concept is defined in the housing sector?
2- What are the factors affecting quality in the housing sector?

3- What is the relative importance (e.g. Highest and Lowest) of such factors from the view point of architects and contractors?

4- What is the applicable framework for quality factor?

1.3 Research Importance and Contributions

The importance of this study stems from the increased competition in the construction industry forcing construction companies to pay more attention on ways for improving their market share, market image and ultimately their profit. Management of the housing industry in developing countries, such as Jordan, faces many challenges. Most of the companies are struggling with the problems of implementation quality and have had limited success. The industry is shifting from traditional management of time and costs to long-term one and a huge number of large scale projects focusing on quality-oriented and therefore need further development. In addition, contractors and architects do not understand the full scope of quality. The other challenge is that very limited research has concentrated on the quality factors in construction sector especially in the Middle East. Thus, this supports the requirement for more effort to improve the quality in housing sector, with the establishment of the most relative importance of factors for a framework of quality in the Jordanian housing sector. Consequently, it will provide experiences to the construction industry in order to understand the quality factors.

In the current research, several contributions are made to quality field. They are split into theoretical and practical contributions. Theoretical contributions are made to quality field in order to expand the growing body on its literature by providing a framework for the quality factors. This is in order to identify empirically the most relative factors. The practical contributions to quality practice are provided to managers,

which are more applied in nature and provide recommendations of quality management in construction sector

1.4 Research Objectives

1. To understand the quality concept in the Jordanian housing sector.
2. To identify the most important factors affecting quality in the Jordanian housing sector.
3. To indicate the relative importance (e.g. highest and lowest factors) of quality factors from the view point of architects and contractors in the Jordanian housing sector.
4. To propose a new framework for quality factors that is appropriate for the Jordanian housing sector.

1.5 Organization of the Research

This study is divided into five chapters, the details of which are presented below.

The first chapter is the introduction of the study. Chapter Two presents the literature review. The research framework and the methodology are presented in Chapter Three. Chapter Four presents data analysis, results and discussion. Finally; conclusions, recommendations, and future work are presented in Chapter Five.

CHAPTER TWO
LITERATURE REVIEW

This chapter aims to present the literature related to quality field. The chapter elaborates on the understanding of quality in order to explain quality in construction, its importance and factors.

2.1 Quality

Arditi and Gunaydin (1997) define quality as meeting the legal, aesthetic and functional requirements of a project. But, however expressed, quality is obtained if the stated requirements are adequate and conform to the requirements. The concept of quality can be translated into the quality dimensions that include: conformance, levels of quality, reliability and safety, quality performance, durability and serviceability (Ofori et al., 2002; McGoerge and Plamer, 2000; Luu et al., 2008). In addition, Jung and Wang (2006) emphasize that it is the role of management to ensure the achievement of established requirements as competition increases and change occurs in the business world. The evolution of quality management into an all pervasive philosophy of management took sharp through the works of Crosby (1979), Deming (1982, 1986), Feigenbaum (1983), Ishikawa (1972), Juran (1988) and Taguchi (1982). The primary focus of quality philosophy is on the hands and minds that employ the tools and techniques rather than the tools and techniques themselves (Krajewski, et.al, 2007; Montgomery, 2005).

Quality can also be defined from a functional point of view, by how closely the project conforms to its requirements. Using this definition, a high quality project can be described by such terms as ease in understanding drawings, level of conflict in drawings and specifications, economics of construction, ease of operation, ease of maintenance, and energy efficiency (Ardti and Gunaydin, 1997).

Eng and Yousef (2003) defined quality as both a philosophy and a set of guiding principles that represents the foundation of a continuously improving organization. It integrates fundamental management techniques, existing improvement efforts and technical tools in a disciplined approach.

According to Al Nofal et al. (2005), quality requires radical change to traditional management practices. Therefore, even though managers may support the principle of employee participation and input, they are uneasy about giving up their authority (Steiner, 2001). Quality is one of the most complex activities that any company can involve itself in; it requires implementing a new way of managing business and a new working culture which not only affect the whole organizational process and all employees but also demand the allocation of significant organizational resources (Santos et al., 2002).

Quality assurance is all planned and systematic actions necessary to provide adequate confidence that a structure, system or component will perform satisfactorily and conform to project requirements. On the other hand, quality control is a set of specific procedures involved in the quality assurance process. These procedures include planning, coordinating, developing, checking, reviewing, and scheduling the work (Ardti and Gunaydin, 1997).

Quality control is the specific implementation of the quality assurance program and related activities. Effective quality control reduces the possibility of changes, mistakes and omissions, which in turn result in fewer conflicts and disputes. Through the first half of this century, engineers and architects were in total control during the design phase. During the construction phase they carried out a role described as 'supervision', insuring that the owner received his money's worth in terms of quality. In the 1950s and 1960s, owners became increasingly concerned with cost and schedule, areas where design professionals were not providing good control. The emphasis continued to be on quality and control of exposure to liability (Ardti and Gunaydin, 1997; Culp, and Smith, 1992 ; Pheng and Teo, 2004).

In the 1980s came the advent of the construction management project delivery system whereby construction management firms emerged as entities not responsible for design and/or construction, but performing only managerial functions on behalf of the owner from the inception phase to the completion of the construction phase. Inspection and quality control that had traditionally been performed by architects and engineers were now performed by construction management firms. According to O'Brien, one way in which more attention will be given to quality control is development of a project quality control plan. Presently, testing and inspection requirements are scattered throughout the contract specifications.

Each part of companies must work together towards the same goals, recognizing that each person and each activity affects and in turn, is affected by others. As competition increases and changes occur in the business world, the companies look for a high level of effectiveness across all functions and process and choose a quality management as a strategy to stay in the business (Jung and Wang, 2006; Kubal, 1994).

2.2 Quality in Construction

The main participants of the construction project coalition are the client, the architect and the contractor. The interactions and interrelationships between these participants largely determine the overall performance of a construction project. The performance of these participants is also interdependent Hence, in order to perform effectively; a reciprocal requirement exists, whereby each participant requires the other participants to perform their duties effectively and in harmony with the others. Notwithstanding this mutual dependency, the performance of individual participants remains important because overall project performance is a function of the performance of each participant (Soetanto and Proverbs, 2002).

According to Rwelamila and Wisemant (1995), Arditi and Gunaydin (1997) and Turk (2006), quality in the construction industry can be defined as meeting the requirements of the designer, constructor and regulatory agencies as well as the owner. Based on the three studies above, quality can be characterized as follows:

- Meeting the requirements of the owner as to functional adequacy; completion on time and within budget; lifecycle costs; and operation and maintenance.
- Meeting the requirements of the design professional as to provision of well-defined scope of work; budget to assemble and use a qualified, trained and experienced staff; budget to obtain adequate field information prior to design; provisions for timely decisions by owner and design professional; and contract to perform necessary work at a fair fee with adequate time allowance.

- Meeting the requirements of the constructor as to provision of contract plans, specifications, and other documents prepared in sufficient detail to permit the constructor to prepare priced proposal or competitive bid; timely decisions by the owner and design professional on authorization and processing of change orders; fair and timely interpretation of contract requirements from field design and inspection staff; and contract for performance of work on a reasonable schedule which permits a reasonable profit.
- Meeting the requirements of regulatory agencies (the public) as to public safety and health; environmental considerations; protection of public property including utilities; and conformance with applicable laws, regulations,

Moreover, one should also differentiate between product qualities, which is the quality of elements directly related to the physical product itself, and the process quality, which is the quality of the process that causes the product to be either acceptable or not (Culp et al., 1993). For example, "product quality" in the construction industry may refer to achieving quality in the materials, equipment and technology that go into the building of a structure, where "process quality" may refer to achieving quality in the way the project is organized and managed in the three main phases of construction process which are planning and designing phase, construction phase, and operation and maintenance phase (Burati and Oswald, 1993; Arditi and Gunaydin , 1997; Lai and Cheng, 2003).

The role of quality in construction has also been espoused by (Belle, 2000; Burati et al., 1992). In order to emphasize the role of quality, various aspects of quality tools and techniques have been also described in previous studies (Belle, 2000; Metri, 2005; Sommerville and Robertson, 2000). Recently, efforts made to improve quality in

construction are widely reflected in the relevant literature (Arditi and Gunaydin, 1997; Rosenfed et al., 1992; Mallon and Mulligan, 1993; Kiwus and Williams, 2001; Federley and Chase, 1993).

Many companies are frustrated in their effort to improve quality because these companies have exclusively focused on financial measures instead of quality measures (Torbica and Stroh, 1999; Sharmma and Gudanne, 2002). Other studies, in the recent past also observed the failure of quality. These failures are due to the too much effort without proper foundation and focus (Culp et al., 1993). Construction firms, therefore, need to understand the quality factors for their success. Therefore, there is a pressing need to establish quality factors for construction firms.

Although quality has been widely implemented in the Japanese construction industry since the 1980s and in the American construction field since the 1990s, it has not yet been implemented successfully in the Middle East construction field (Abdel-Razek, 1998; Sweis, 2008; Abdel Salam and Gad, 2009; Hiyassat, 2000; Kazaz et al. ,2004).

Many researchers have demonstrated that project management action is a key element in achieving quality in construction. Abdul-Rahman (1996) advocated that the success of managing quality in construction should not be just implementing a system; it should be performed effectively. The success of quality management depends heavily on management practices. These practices include: motivation by the contractor’s senior management; commitment of top managers to site management (Abdel-Razek, 1998; Kaye and Anderson, 1999); integration of continuous improvement activities into the strategic goals across the whole organization, across boundaries and at all levels (Kaye

and Anderson, 1999). These factors were considered as crucial factors affecting the quality of construction.

According to Kazaz and Birgonul (2005) and Turk (2006), construction firms have a business structure using temporary labors changing its location constantly and consequently, having some deficiencies in getting stability in a quality concept. In addition, an achievement of acceptable levels of quality in the construction industry has long been a problem. Great expenditures of time, money and resources are wasted each year due to inefficient or non-existent quality levels. The situation is even worse in the case of housing projects addressed to low and middle income groups. Furthermore, construction projects are widely seen as unpredictable in terms of delivery time, budget, profitability and the standards of quality expected (Love et al., 2000). The following are some differences, which must be considered when applying a quality program to construction (Arditi and Gunaydin (1997; Pheng and Teo, 2004).

- Almost all construction projects are unique. They are single-order, single-production products.
- Unlike other industries, which usually have a fixed site with similar conditions for production, each construction production site always displays different conditions.
- The life-cycle of a construction project is much longer than the life-cycle of most manufactured products.
- There is no clear and uniform standard in evaluating overall construction quality as there is in manufactured items and materials; thus, construction projects usually are evaluated subjectively.
- Since construction projects are a single-order design project, the owner usually directly influences the production.

- § The participants in the construction project- owner, designer, general contractor, subcontractor, material supplier, etc. -differ for each project.

2.3 Factors Affecting Quality in Construction

A careful balance between the owners requirements of the project costs and schedules, desired operating characteristics, materials of construction, etc. and the adequate time and budget to meet those requirements during the design process is essential. Owners balance their requirements against economic considerations and, in some cases, against chance of failure. The constructor is responsible for the means, methods, techniques, sequences, and procedures of construction, as well as safety precautions and programs during the construction process. Project requirements are the key factors that define quality in the process of construction. The factors that affect quality in each phase of the construction process have been identified by the researcher through an extensive literature review.

Porter and Parker (1993) stated that in managing quality, some organizations focus on specific areas such as training, leadership, benchmarking while others take a holistic approach and define quality factors covering the various key areas, and this can be seen from the following literature review where several quality factors for effective quality were identified. Table (1) lists such factors and literature support, where operational definitions of factors are listed in chapter three.

Table 1. A List of Quality Factors and Literature Support

No.	Quality Factor	Supporting Literature
1	**Leadership**	Kagioglou et al. (2000),Arditi and Gunaydin (1997)
2	**Top Management Commitment**	Arditi and Gunaydin (1997); Haupt and Whiteman(2004), Hellard (1991), Lam et al. (2008),Pheng and Hong (2005), Lau and Tang(2009), Sweis (2008)
3	**Customer Satisfaction**	Lai and Cheng (2003), Haupt and Whiteman (2004); Oakland and Aldrdgie (1995), Abdul Alazi (2002), Abdel Razek (1998), Chan et al.(2006) ,Pheng and Hong (2005), Lau and Tang(2009) ,Pheng and Wei (1996), Chan and Chan (2004), Kagioglou et al. (2000)
4	**Supplier Management**	Lai and cheng (2003), Arditi and Gunaydin (1997), Haupt and whiteman (2004), Oakland and Aldrdgie (1995), abdul alazi (2002), Abdel razek (1998),Hellard(1991), Chan et al.(2006), Lam et al.(2008), Pheng and hong (2005), Metri (2005), Pheng and Wei (1996)
5	**Process Management**	Lai and cheng (2003), Oakland and Aldrdgie (1995) , Abdel- Razek (1998), Lam et al. (2008), Lau and Tang (2009), Metri (2005), Pheng and Wei (1996), Kagioglou et al. (2000).

Table 1. A List of Quality Factors and Literature Support (continued)

No.	Quality Factor	Supporting Literature
6	**Resources**	Abdel Razek (1998) ,Hellard(1991), Metri (2005)
7	**Continuous Improvement**	
	- **Statistical Process Control**	Lai and Cheng (2003), Arditi and Gunaydin (1997) , Walker and keinger (2002), Abdul Alazi (2002), Abdel-Razek (1998), Chan et al. (2006), Lam et al. (2008) , Metri (2005), Pheng and Wei (1996).
	- **Benchmarking**	Abdel- Razek (1998)
8	**Human Resource Management**	
	- **Employee Involvement**	Lai and Cheng (2003),Arditi and Gunaydin (1997) , Haupt and Whiteman(2004), Oakland and Aldrdgie (1995), Abdul Alazi (2002), Chan et al.(2006), Lam et al. (2008), Pheng and Hong (2005), Metri (2005) , Kagioglou et Al.(2000), Akintoye & Fitzgerald(1995)
	- **Teamwork**	Santos and Powell (2001), Kagioglou et. al. (2000)
	- **Training and Education**	Arditi and Gunaydin (1997), Abdel Razek (1998), Hellard(1991), Chan et al.(2006), Lam et al. (2008), Pheng and Hong (2005), Metri (2005)

Table 1. A List of Quality Factors and Literature Support (continued)

No.	Quality Factor	Supporting Literature
9	**Culture**	Lai and Cheng (2003), Oakland and Aldrdgie (1995), Hellard(1991), Chan et al. (2006), Lau and Tang (2009), Metri (2005), Walker and Keinger (2002)
10	**Strategic Management**	Lai and Cheng (2003); Haupt and Whiteman (2004), Abdel- Razek (1998) ,Hellard (1991), Lam et al. (2008),Metri (2005)
11	**Uses of Technology**	Kartam (1999), Downs and Eastamn (2000)
12	**Quality Management Systems**	Djebarni and Eltigani (1996), Santos et al. (2002), Shen and Walker (2001), Walker and Keinger (2002)
13	**Construction industry – Specific Factors**	
	- **Codes and Standards**	Arditi and Gunaydin (1997), Santos et al. (2002), Shen and Walker (2001) , Pheng and Wei (1996)
	- **Drawing and Specification**	Arditi and Gunaydin (1997), Pheng and Wei (1996)
	- **Constructability of Design**	Arditi and Gunaydin (1997)

CHAPTER THREE
RESEARCH FRAMEWORK AND METHODOLOGY

3.1 Theoretical Framework

Many previous studies highlighted the factors affecting quality of construction. Each study has contributed to identifying some factors affecting quality. However, there is a little published work that comprehensively addresses the factors specifically affecting the quality of construction in the different parts of the world. Researchers still differ in their perceptions as to what should be emphasized most among the different factors affecting quality. Moreover, few studies have been conducted in the Middle East regions that are addressing quality factors in construction.

Extensive literature review has been carried out to select a framework for this study. As some authors have developed a similar approach to identify and investigate the factors of success as a total framework in construction industry. The relevant literature has revealed that different countries have adopted similar quality frameworks in the form of quality awards with a different title. Today, there are more than a hundred quality awards existing in different countries. However, all these quality awards are basically derived from three basic awards: the Malcolm Baldrige National Quality Award (MBNQA), the European Quality Award (EQA) and the Deming Prize. This study, therefore, includes these three basic awards as quality frameworks along with other frameworks developed by others. Based on the quality expert prescriptions for a stable quality-driven environment, Table 2 summaries the most popular perspectives on quality.

Table 2. Perspectives of Quality

Deming's 14 points	The Juran TRILOGY	Crosby's 14 quality steps
1. Consistency of purpose 2. Adopt the philosophy 3. Do not rely on mass inspection 4. Do not award business on price 5. Constant improvement 6. Training 7. Leadership 8. Drive out fear 9. Break down barriers 10. Eliminate slogans and exhortations 11. Eliminate quotas 12. Pride of workmanship 13. Education and retraining 14. Plan of action	1. Quality Planning -Set goals -Identify customers and their needs -Develop products and processes 2. Quality control -Evaluate performance -Compare to goals and adapt 3. Quality improvement -Establish infrastructure -Identify projects and teams -Provide resources and training -Establish controls	1. Management commitment 2. Quality improvement teams 3. Quality measurement 4. Cost of quality evaluation 5. Quality awareness 6. Corrective action 7. Zero-defects committee 8. Supervisor training 9. Zero-defects day 10. Goal-setting 11. Error cause removal 12. Recognition 13. Quality councils 14. Do it over again

Haupt and Whiteman (2004) have conducted a study in the United States to identify factors affecting the actual field operations of a construction jobsite. These

factors were identified through a literature review and a survey of a sample of contractors. The study revealed the following factors in rank order:

1. Management commitment and involvement.

2. Customer satisfaction.

3. Well developed planning.

4. Participative management style (employee involvement, empowerment, teamwork).

5. Continuous improvement measurement.

6. Rewards for quality contribution.

7. Training of workers.

Moreover, Pheng and Hong (2005) have done a study in Singapore which involved the participation of project managers in the construction industry. A survey was used to obtain a consensus conclusion on the factors required to improve construction quality in Singapore, along with their relative importance. The respondents generated eight factors and the relative importance of each factor was determined. For example, the first factor in order of priority was total commitment .Second, was strategic quality management, and followed by customer-driven service, eliminating rework, teamwork, and training, empowering and respecting people.

Furthermore, Lam et al. (2008) have explored the extent of quality in Hong Kong large-sized public building contractors. The survey results show that there is a significant difference in the six quality factors through one-way ANOVA, descriptive

statistics, multivariate tests and correlation matrix were employed to analyze the results. They concluded that Hong Kong building contractors should pay more attention to the strategic planning, human resources management and leadership in order to attain the goal of continuous improvement which gives the most important issue to the first three factors then to, process management, customer and market focus, measurement, analysis and knowledge management, then the results.

Fourteen quality frameworks for construction industry have been promoted by different authors, for the purpose of establishing construction quality factors in this study. A detailed analysis of the frameworks is carried out and presented in Table 3.

Table 3. Analysis of Quality Frameworks

Author	Country	Quality Factors
Hellard (1991)	U. k	- team building -planning and documentation - leadership - customer involvement - education - culture (attitude change) - resources
Oakland and Aldrdgie (1995)	U.K	- process - customer-supplier quality chains - quality systems - tools and techniques - teamwork - culture - commitment to quality at all levels - communication
Pheng and Wei(1996)	Singapore	- customer satisfaction - construction specific factors - ISO 9000 - subcontractors involvement - continuous improvement
Arditi and Gunaydin (1997)	Hong Kong	- team work - statistical methods - customer service - supplier involvement - cost of quality - training - management commitment - leadership - statistical methods - construction specific factors
Abdel razek (1998)	Egypt	- design and planning during the pre construction phase - quality control and assurance systems -improving the financial level and standards of living of employees - accuracy of estimating and tendering - proper classification of contractors, consultants and construction projects - training for contractors, owners and consultants - encouraging the accreditation ISO 9000 - maintenance systems during and after construction - utilization of resources - more specialization in construction work - innovation for simpler and more accurate construction methods

Table 3. Analysis of Quality Frameworks (continued)

Author	Country	Quality Factors
Abdul alazi (2002)	Malaysia	-market in concept :client satisfaction - turn PDCA cycle (control cycle) - thinking based on data and facts - Participation by all members
Lai and Cheng (2003)	Hong Kong	- people and customer management - supplier partnerships - communication of improvement - customer satisfaction - external interface management - strategic quality management - teamwork structures for improvement - operational quality planning - quality improvement measurement systems - corporate quality culture
Pheng and Teo (2004)	Singapore	- top management commitment - customer involvement and satisfaction - employee involvement and empowerment - customer–supplier relationships - process improvement
Metri (2005)	India	- top management commitment - quality culture - strategic quality management - design quality management - Process management - supplier quality management - education and training - empowerment and involvement - information and analysis - customer satisfaction -resources
Chan et al. (2006)	Hong Kong	- appointing a project manager with extensive experience in running public housing projects - fostering a proactive quality culture - increasing usage of direct skilled labour - adopting a comprehensive inspection system on subcontractors work - increasing competency of site labour - the clients emphasis on quality, safety and environment
Lau and Tang (2009)	Hong Kong	- responding and resolving clients complaints - continual review of construction safety - work environment the construction quality - culture - commitment of every one

After a review of the literature on quality factors in construction, it appears that not all the factors have the same frequency and importance but they complement one another.

Accordingly, relying on the previous researches findings about factors affecting quality in construction, this study uses 13 quality factors as most relevant. The factors that have been identified are shown below.



Figure 1. The Theoretical Framework for Quality Factors

Table 4 illustrates the operational definitions of quality factors from the view point of previous authors.

Table 4. Operational Definitions for Quality Factors

Factor	Definition
Quality	The meeting the requirements of the designer, constructor and regulatory agencies as well as the owner. Quality dimensions include: conformance, levels of quality, reliability and safety, quality performance, durability and serviceability (Ofori et al., 2002; McGoerge and Plamer, 2000; Luu et al., 2008).
Customer Satisfaction	Determine customer requirements and success in meeting them no matter what it takes, and building relationships and loyalty also respond quickly with new ideas and technology that satisfied or exceed customer satisfaction (Metri, 2005; Arditi and Gunaydin, 1997).
Human Resources Management	The success of efforts to develop and realize the full potential of the workforce for quality.
- **Training**	Usually includes quality concepts, team skills, and problem solving, instructions, technical and managerial skills and targeted for everyone (Hellard, 1991; Lam et al., 2008; Metri, 2005; Arditi and Gunaydin, 1997).
- **Involvement**	Increased employee involvement as a part of team in design and planning, and greater autonomy in decision-making and improvements (Metri, 2005; Arditi and Gunaydin, 1997).
- **Team work**	A well-planned team structure which get everyone, providing

Definitions of Factors (continued)

Factor	Definition
	companies with the structured environment necessary for successfully implementing and continuously applying the process (Metri, 2005; Arditi and Gunaydin, 1997).
Process management	The effectiveness of processes for assuring the quality of all operations, adding value , raising productivity and integrates production and delivery requirements and manages the Performance as expected, without breakdowns, shortage/missing materials, tools, etc. (Pheng and Teo, 2004; Lam et al., 2008; Metri, 2005).
Leadership	The senior executives success in creating and sustaining a quality culture and managing people. Also leadership should set organizational vision and mission to guide and improve performance, promote frank and two-way communication throughout company, govern and address social responsibilities, and promote and ensure ethical behavior in work (Hellard, 1991; Metri, 2005; Lam et al., 2008).
Top management commitment	Long term visibility and support by top managers to the quality, Continuous Improvement, or Quality Improvement through action (Pheng and Teo, 2004; Lam et al., 2008; Metri,2005; Arditi and Gunaydin ,1997).
Uses of Technology	The adoption of new technology such as three-dimensional Computer-aided drafting and design, robotics, and automation (Arditi and Gunaydin, 1997).

Definitions of Factors (continued)

Factor	Definition
Supplier management	Working closely and cooperatively with suppliers, ensuring they provide inputs that conform to customers end-use requirements. includes fewer dependable subcontractors, reliance on suppliers process control, purchasing policy, emphasizing quality rather than price (Pheng and Teo, 2004; Lam et al., 2008; Metri,2005 ;Arditi and Gunaydin ,1997).
Strategic management	**Definition 1:** The effectiveness of integrating quality requirements into business plans, put into practice by the inclusion of quality objectives in the strategic planning process and through strategic planning frameworks (Metri, 2005; Arditi and Gunaydin, 1997). **Definition 2:** Examines how the organization develops and deploys strategic objectives and action plans .Strategy development includes embodiment of short- and longer-term planning time horizons in strategic objectives, collecting and analyzing relevant data as strategic planning process, and the balance of strategic development. Strategy deployment consists of the embodiment of organization's key strategic objectives in work and actions, flexibility for organization's Strategy and including stakeholders in deployment of strategy (Lam et al., 2008).

Definitions of Factors (continued)

Factor	Definition
Continuous improvement	The effectiveness of information collection and analysis for quality improvement and planning consist of evaluation for various policies and strategies, quality audit, analysis of quality costs, department/function performance evaluation, and employee and supplier performance evaluation. The Japanese were the forerunners of the concept of "kaizen" or "continuous improvement". Continuous improvement is increasingly becoming the life-blood of any quality management organization. Deming (1986) emphasized the importance of continuous improvement in his philosophy wherein he states: "Improve constantly and forever the system of production and service, to improve quality and productivity; and thus constantly decrease costs.
Statistical methods	Provide problem-solving tools to the process, and tools to identify the causes of quality problems. The most commonly used statistical methods are histograms, cause and effect diagrams, check sheets, Pareto diagrams, graphs, control charts, and scatter diagrams (Pheng and Teo, 2004; Lam et al., 2008; Metri, 2005; Arditi and Gunaydin ,1997).
- Benchmarking	Researching and observing best competitive practices (competitor or industry leaders) (Pheng and Teo, 2004; Lam et al., 2008; Metri, 2005; Arditi and Gunaydin, 1997).

Definitions of Factors (continued)

Factor	Definition
Construction Specific Factors	many characteristics that distinguish construction
- Codes and Standards	Directly control the minimum criteria of standards of many components of a building project, and are responsible for much of the finished product quality to protect the publics health and safety (Arditi and Gunaydin, 1997).
- Drawings and Specifications	They are the two sets of documents given to the constructor that provide technical information (that show the design concept, size and scope of the job, number and size of materials or items, and how they are assembled into a final project), performance of the constructed facility, and quality requirements (Arditi and Gunaydin ,1997).
- Constructability of Design	Designs must also be reviewed for effectiveness and compatibility with local requirements, because construction techniques vary in different geographical areas and including both the initial construction and post construction operations. The desired result is to facilitate the exchange of ideas between construction and design before and during design, rather than after design (Arditi and Gunaydin, 1997).

Definitions of Factors (continued)

Factor	Definition
Culture	Use of information for improvement, authority equal to responsibility, job security, climate of fairness, compensation based on equality, teamwork, collaboration, learning and involvement, ownership, and development form an organizational culture, which then leads to increases in productivity, quality, and customer and employee satisfaction (Metri,2005).
Quality management systems	Designed to provide both support and mechanism for the effective conduct of quality related activities. In company, using ISO 9000 series which comprise two basic types of standard : those addressing quality assurance (contractual and assessment purpose) and those addressing quality management (developing and implementing quality systems) (Metri,2005 ;Arditi and Gunaydin ,1997).
Resources	Men, materials, machines, methods and money - monitoring them within the framework of the law on the one hand, and within the established customs and practices on the other (Hellard, 1991).

3. 2 Methodology

Due to the dearth of real data relating to quality in the Jordanian housing projects, the researcher uses an exploratory method to identify the most related quality factors. The researcher also developed a survey questionnaire to assess the perception of contractors and architects of the relative importance of factors affecting quality in the Jordanian housing sector as well as measuring the differences in their perception. This will enable the researcher to understand the quality focusing on its factors. The present

aim of this study was then identified: factors affecting quality in the Jordanian housing sector and their relative importance.

In fulfilling this aim, four objectives are considered important. First, understanding the quality concept; second, identifying the most important factors affecting quality; third, indicating the relative importance (e.g. highest and lowest factors) of quality factors from the view point of architects and contractors, and fourth, proposing a new framework for quality factors. In support of the research aim and objectives three parts (research design, data collection and data analysis) are undertaken.

3.2.1 Research Design

The researcher defines a well-organized design in order to identify and understand the quality factors and their importance in the housing sector in Jordan. This exploratory research includes two phases (extensive review of the literature and survey questionnaire by personal interviews).

The research design started with identifying a research problem, and then it provided a review of the available literature in Chapter 2 in order to understand previous research in quality and relevant fields. This was to identify the key factors and their relative importance in the existing research. This led to a determination of the key aim and objectives, and then providing the initial theoretical framework above for quality factor. The questionnaire survey is then used based on personal interviews with the contractors and architectural companies in the Jordanian housing sector.

3.2.2 Data Collection

For the purpose of collecting data, a designed questionnaire was used. The survey was conducted by means of structured personal interviews within two months (September and October,2010), carried out face to face for checking the information accuracy, and developing an understanding of quality factors based on the designed questionnaire.

During the interviews, interviewees were briefed on research problem, research objectives and quality factors. The interviews were conducted at the premises of the selected companies that agreed to participate. The questionnaire was answered by contractors and architects who were in charge of quality awareness to ensure that the respondent has the necessary knowledge to respond.

All the companies included in the survey were located in Amman due the constraints of time and cost. Amman is considered to be the main economic hub of the country, and 77 % of the housing projects are concentrated there (JEA, 2009).

3.2.2.1 Questionnaire

A questionnaire was designed to meet the objectives of the survey. Most of the survey questions were adopted from previous literature that had been used to determine the factors affecting quality in construction such as those detailed in Table 2. The questionnaire consisted of two parts: the demographic information of respondents and quality factors (Appendix A).

The importance of factors affecting quality was measured using a perceptual measure on a five-point likert scale to ensure consistency and the ease of data computation. The perceptual measures are in the form of attitude statements with (1 = totally disagree, 2 = generally disagree, 3 = somewhat agree, 4 = generally agree, and 5 = totally agree).

It was important to have a valid instrument for measurement, so the process of developing the questionnaire ended with a pre-test, which were used to modify and eliminate a number of variables. However, it was found to be valid on the basis of our study.

3.2.2.2 Population and Sample

The list of ISO 9000 certified companies (as of June, 2010) was obtained from Jordan Institution for Standards and Metrology. This list contained the name, telephone and fax number and the certification body for 283 certified firms in Jordan. Of these firms, only 4 of them are construction firms. Companies that were ISO 9000 certified were used in the population to capture the benefits and to ensure the maturity of the system in the firms

An exploratory pilot study was conducted at Jordanian Engineering Association (JEA), Jordan Construction Contractors Association (JCCA), Ministry of Public Work and Housing, Ministry of Industry and Trade (MIT), to seek out detailed information regarding the potential participants constituting the housing sector in Jordan.

The population of the study consists of working contractors and architects in the Jordanian housing sector which was obtained from the lists of JEA , JCCA and MIT

which carefully verified and cross-checked to ensure complete and up-to-date information, as follows:

1. Contractors: Contracting companies are classified by Ministry of Public Work and Housing into six classes according to their capital, and their experience in completing projects with a minimum total value .As considerably meeting in JCCA, the classes which usually take the housing projects are classes D, E as summarized in Table 5 which comprise 243 companies (JCCA, 2009).

Table 5. Classes of contractors

Class	Capital (JOD)	Equipment price (JOD)	Maximum Total Value of project (JOD)	Technical Person	Number of Companies
A	500000	250000	---	engineer	76
B	300000	150000	5 Million	engineer	66
C	150000	50000	2 Million	engineer	155
D	50000	30000	750000	civil engineer	115
E	20000	10000	250000	civil or architect engineer	128
F	10000	5000	100000	observer	424

2. Architectural firms, Consulting companies and Engineering offices:

They represent a number of 1198 companies and offices (JEA, 2009). According to the JEA, Architectural Firms, Consulting Companies and Engineering offices share similar architectural activities; thus they are classified under same category. This point was taken into consideration when the population of the study was selected, and for the purpose of the study, the researcher chose 85 companies and offices of which their capital exceeds JOD 10000 (MIT,2010;JEA,2009).

The sampling was confined to specific types of companies conforming to the criteria set by the researcher:

- Contracting companies where their capital between JOD 20000 and JOD 50000 (class D and E).
- Architectural companies with capital in excess of JOD 10000.

The researcher chose to follow a census sampling approach "where the sample size equals the population size" .Therefore the sample size for contractors equals 243 while the sample size for the architects is 85.The response rates were: 61.2 % & 22.6 % for architects and contractors respectively.

3.2.2.3 Limitation of Data Collection

Although the data collection method used for this research was interesting and successful, but in this research there were some limitation as the following:

1. Many refused to participate in the questionnaire especially in the contractors population.
2. Knowledge not available especially with contractors, since the range of contractors experience varied from those who have built just once in their lifetime to those who have a continuous building programme.
3. Some questions may not be answered in full.
4. Time and cost are the major constraints to the research.

3. 2.3 Data Analysis

This study implemented a number of statistical techniques and procedures to answer the questions of study. Descriptive statistics and reliability analysis were carried out to estimate the internal consistency of items, where Cronbach's coefficient, α, was selected for this test. Then, *t*-test (one-tailed) at 95 percent confidence level was conducted among the means of responses from the two groups (contractors and architects) to check any significant differences among the groups perceptions regarding the importance of various factors.

All statistical procedures were estimated using Statistical Package for Social Sciences (SPSS) version 15.0 (Gerber and Finn, 2005).

In order to increase the validity of the research findings, the researcher also uses cause-effect diagram (Fishbone) in the analysis procedure in order to explore the theoretical links of the factors affection quality in the Jordanian housing sector. Dr. Ishikawa encouraged the use of seven tools of quality, including the one he developed (The Fishbone Diagram) which is an easy to use and effective cause-and-effect technique). The diagram refers to its use in identifying the causes of various quality characteristics, including problems (Ozeki and Asaka, 1990). This type of analysis will illustrate the most important quality factors and their variables in order to support the new proposed framework for the current study.

CHAPTER FOUR
DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Profile of Demographic Respondents

Table 6 and Table 7 show the details of the first part of questionnaire, which includes demographic information about the respondents (contractors and architects).

The responses indicated that the majority of contractors who participated in the study were 100 % male and 49.1 % with ages ranging between 41 and 50 years old. The contractors were well experienced professionals and were able to give reliable data.

89.9 % of them had over a five years experience in the construction industry and over 49.1 % of them had over a ten years experience as shown in Table 4. All of the respondents have graduated from high school and 72.7 % over half of them hold bachelor degree.

Amongst the architectural companies, large proportions 65.4 % of the respondents were male and 34.6 % were female. The statistical results show that about 55.8 % were less than 40 years, 78.8 % over half of them hold bachelor degree, and 15.4 % of the participants have completed graduated studies.

About 11.5 % of the respondents had less than 5 years experience, 21.2 % between 6-10 years, 55.8 % between 10-15 years, and 11.5 % over 15 years.

Table 6. Contractors' Demographic Profile

Factor	Sub-factor	Percentage	Chart
Gender	Male	100 %	Gender
	Female	0 %	
Experience	1-5	14.5 %	Experience
	6-10	20.0 %	
	11-15	49.1 %	
	Over 15	16.4 %	
Education	High school	0 %	Eduacation
	Diploma	27.3 %	
	Bachelor	72.7 %	
	Higher education	0 %	
Age	20-30	14.5 %	Age
	31-40	20.0 %	
	41-50	49.1 %	
	Over 50	16.4 %	

Table 7. Architects Demographic Profile

Factor	Sub-factor	Percentage	Chart
Gender	Male	65.4 %	Gender
	Female	34.6 %	
Experience	1-5	11.5%	Experience
	6-10	21.2 %	
	11-15	55.8 %	
	over 15	11.5 %	
Education	High School	0 %	Eduacation
	Diploma	0 %	
	Bachelor	78.8 %	
	Higher Education	15.4 %	
Age	20-30	11.5 %	Age
	31-40	21.2 %	
	41-50	55.8 %	
	over 50	11.5 %	

4.2 Validity

An instrument has content validity if researchers agree that the instrument is made up of a group of items covering the issues to be measured.

In order to ensure the validity of the questionnaire, the researcher utilized the available literature discussed in chapter two. On the other hand, the pre-test consisted of a first revision of the questionnaire with five people (different academic staff of the engineering faculty at the University of Jordan) in order to ensure technical accuracy, clarity and to improve the questionnaire in terms of its format, layout, the wording of statements, and the overall content.

4.3 Reliability Analysis

An experiment is considered reliable if it yields consistent results of the same measure. The reliability of the construct can be measured in several ways. The internal consistency method was used to measure its reliability. This can be estimated by means of a reliability coefficient, such as Cronbach's alpha, which measures the internal consistency of a multidimensional scale. Alpha values which are equal to or greater than 0.7 indicate high construct reliability, although it may be reduced to 0.6 in exploratory research or even to 0.55 (Sekaran, 2003).

We can conclude that the coefficient of Cronbach's alpha, which indicates the reliability, for all factors was 0.82. This indicates a high level of reliability which is above the recommended minimum level 0.60 for social sciences.

4.4 Statistical Methods

4.4.1 Descriptive Statistics

The ranking of factors affecting quality in the Jordanian housing sector was determined by taking the respective average scores of the reported data for all respondents. The factors, their means and standard deviations values from the view point of the contractors, architects, and contractors and architects combined were ranked in descending order according to the highest average in the group response, as shown in Tables 8, 9 and 10 respectively.

Table 8. Ranking of Factors from the View Point of Contractors

Factors	Contractors		
	Mean	S.D	Rank
Human Resource Management	4.44	0.573	1
Customer Satisfaction	4.31	0.605	2
Top Management Commitment	4.26	0.700	3
Supplier Management	4.16	0.788	4
Construction Specific Factors	4.10	0.429	5
Leadership	4.07	0.634	6
Quality Management Systems	3.96	0.860	7
Uses of Technology	3.91	0.908	8
Process Management	3.89	0.497	9
Strategic Management	3.85	0.488	10
Culture	3.80	0.621	11
Continuous Improvement	3.62	0.638	12
Resources	3.58	0.875	13

Table 9. Ranking of Factors from the View Point of Architects

Factors	Architects		
	Mean	S.D	Rank
Human Resource Management	4.42	0.583	1
Customer Satisfaction	4.33	0.513	2
Uses of Technology	3.88	0.784	3
Construction Specific Factors	3.88	0.722	4
Culture	3.73	0.866	5
Supplier Management	3.73	0.910	5
Quality Management Systems	3.71	1.016	6
Top Management Commitment	3.69	0.781	7
Leadership	3.54	0.851	8
Process Management	3.54	1.093	8
Resources	3.50	0.828	9
Continuous Improvement	3.30	0.788	10
Strategic Management	3.25	1.235	11

Table 10. Ranking of Factors from the View Point of Contractors and Architects Combined

Factors	Overall		
	Mean	S.D	Rank
Human Resource Management	4.43	0.577	1
Customer Satisfaction	4.32	0.559	2
Construction Specific Factors	3.99	0.575	3
Top Management commitment	3.97	0.740	4
Supplier Management	3.95	0.848	5
Uses of Technology	3.9	0.846	6
Quality management Systems	3.84	0.938	7
Leadership	3.81	0.742	8
Culture	3.77	0.752	9
Process Management	3.71	0.795	10
Strategic Management	3.55	0.861	11
Continuous Improvement	3.46	0.713	12
Resources	3.45	0.852	13

4.4.2 *t*-tests results

First, the homogeneity of variance must be examined to know if the variances assumed are equal or not at significance 95 % (α = 0.05) then *t*-test is conducted. For this purpose, the researcher examine these statistical hypotheses, if significance "p" value is less than 0.05; then reject the null hypothesis (H_0), implying that the variances are unequal.

H_0: there is no difference in variances of contractors and architects ($\sigma 1 = \sigma_2$) (equal variance)

H_1: there is difference in variances of contractors and architects ($\sigma 1 \neq \sigma_2$)

The results of homogeneity of variance for the highest and the least common factors are demonstrated in Tables 11 and 12, respectively.

Table 11. Homogeneity of Variance for the Three Highest Factors Ranked according to Contractors and Architects Combined

Quality Factors	P value at α =0.05	Variance assumed	Sig (2-tailed)
Human Resources Management	0.881	Equal	0.86
Customer Satisfaction	0.206	Equal	0.870
Construction Specific Factors	0.014	Not Equal	0.06

Table 12. Homogeneity of Variance for the Three Lowest Factors Ranked according to Contractors and Architects combined

Quality Factors	P value at α =0.05	Variance assumed	Sig (2-tailed)
Strategic Management	0.0	Not Equal	0.002
Continuous Improvement	0.627	Equal	0.022
Resources	0.760	Equal	0.621

Consequently, the independent samples *t*- test was conducted to investigate whether there were any significant differences among the selected quality factors from the view point of both contractors and architects.

The *t*-test was carried out for the three highest factors from the view point of both contractors and architects combined: human resources management, customer satisfaction, construction specific factors, and the three lowest factors combined: strategic management, continuous improvement, and resources.

Null hypothesis:

H_0: $\mu_1 \leq \mu_2$; i.e. there is no significant difference in the mean of population between contractors and architects (for quality factors: human resources management, customer satisfaction, and construction specific factors).

Alternative Hypothesis:

H_1: $\mu_1 > \mu_2$; i.e. there is a significant difference in the mean of population between contractors and architects (for quality factors: human resources management, customer satisfaction, and construction specific factors).

The result of the *t*-test is given in Table 13 for highest factors and in Table 14 for the lowest factors.

Table 13. *t*-test for the Most Common Highest Factors

Quality Factors	Sig (2-tailed)	p-value one- tail(p\2)	Statistical hypothesis conclusion
Human Resources Management	0.86	0.43	Equal in opinion, no sig.
Customer Satisfaction	0.870	0.435	Equal in opinion, no sig.
Construction Specific Factors	0.06	0.03	Differ in opinion, sig.

Table 13 indicated that there is a strong agreement among the two groups on the two factors; human resources management and customer satisfaction. Also, there is a factor with significant difference between scores of contractors and architects; construction specific factor. Table 14 concludes that the architects believe that construction specific factors have higher level of effect on quality than do the contractors.

Table 14. *t*-test for the Most Common Lowest Factors

Quality Factors	Sig (2-tailed)	p-value one-tail(p\2)	Statistical hypothesis conclusion
Strategic Management	0.002	0.001	Differ in opinion, sig
Continuous Improvement	0.022	0.011	Differ in opinion, sig
Resources	0.621	0.3105	Equal in opinion, no sig.

4.5 Discussion of Results

The following discussion deals with the three highest factors (human resources management, customer satisfaction, and construction specific factors) and the three lowest factors (strategic management, continuous improvement, and resources) that contribute to quality of the Jordanian housing sector from the view point of contractors and architects combined.

In this part, the results of data analysis will be discussed in light of the literature review discussing the subject of quality as it is applied specifically to the Jordanian housing sector.

4.5.1 The Highest Three Factors

4.5.1.1 Human Resources Management (Team Work, Involvement, Training and Education)

In this research, Human resources management is the first highest factor from the view point of contractors and architects combined, and 4.43 on average of mean.

However, there is no significant difference according to the mean of overall averages of the contractors and architects concerning this factor.

Table 15 shows that human resources management (education and training, involvement, teamwork) is considered as the most important factor which affects quality in many countries.

Table 15. Supportive Studies of Human Resources Management

Factor	Country	Author	Respondent
Human Resource management	United States	Haupt and Whiteman (2004)	contractors
		Arditi and Gunaydin (1997)	construction industry
	Singapore	Pheng and Hong (2005)	project manager in construction industry
		Pheng and Teo (2004)	Construction contractors
	Hong Kong	Lam et al. (2008)	large-sized public building contractors
		Chan et al. (2006)	public housing project manager
		Lai and Cheng (2003)	Quality manager in public housing
	U.K	Oakland and Aldrdgie (1995)	Construction industry (consultant)
		Hellard (1991)	construction industry
	Egypt	Abdel- Razek (1998)	Contractor and consultan
	India	Metri (2005)	construction industry
	Australia	Sharmma and Gudanne (2002)	CEO of construction industry
	Malaysia	Abdul -Alazi (2002)	contractor

Many research results have revealed that education and training are the most important elements affecting quality. This result is in agreement with conclusion drawn by (Chan et al., 2006; Lam et al., 2008; Lai and Cheng, 2003) in Chinese companies where was conducted for public housing, and also in agreement with pheng and Hong (2005) in Singaporean companies from the view point of contractors, and also in agreement with studies of (Hellard,1991; Metri,2005). In addition, Australlian construction companies stated that they had an on going quality training programmes, which suggest that they consider quality as an important business strategy (Sharmma and Gudanne, 2002) . In the U.S.A, a study by Arditi and Gunaydin (1997) emphasized that training should be targeted to every level of the company and in all stages of construction.

Findings from Egyptian survey in 1998 by Abed-razek reflected that not only the impact of training on quality was important but the most important factor was the need to develop and up-grade the current training methods.

Construction project by its nature necessitates to a certain degree a transient workforce. Each project is built on a new construction site, and so effective team work on jobsite is essential which will lead to a better support and a quickly response to all members so both the construction managers and workers require a paradigm shift to team approach which lead to a better support and quick response to all member (Haupt and Whiteman, 2004; Lai and Cheng, 2003; Hellard, 1991; Pheng and Hong, 2005).

From the perspective of human resources management, labour will no longer be considered as a commodity and a cost to be minimized, but they will be a vital investment for companies success (Pheng and Teo, 2004).

Clearly, the entire construction industry can be considered as project oriented. Therefore improved quality which includes the entire project team (contractor, subcontractor, supplier, designer, project manager, and above all, the customer) must be involved in the process (Pheng and Teo, 1996; Arditi and Gunaydin, 1997). Several authors suggest the importance of involvement in decision making which enhances the individuals self-esteem and improves ability to solve problems and to make low-risk decisions (Abdul Alazi, 2002; Abdel- razek, 1998; Metri, 2005; Pheng and Teo, 2004).

4.5.1.2 Customer Satisfaction

It is not surprising that most respondents understand the importance of customer satisfaction and emphasized the satisfaction of customers in support of overall quality

and ranked it as the second most important factor. Also, there is no significant difference in the mean of responses of contractors, architects regarding this factor.

Table 16. Supportive Studies of Customer Satisfaction

Factor	Country	Author	Respondents
Customer Satisfaction	United States	Haupt and Whiteman (2004)	contractors
		Arditi and Gunaydin (1997)	construction industry
	Singapore	Pheng and Hong (2005)	project manager in construction industry
		Pheng and Teo (2004)	Construction contractors
		Pheng and Wei (1996)	construction industry
	Hong Kong	Lam et al. (2008)	large-sized public building contractors
		Lau and Tang (2009)	contractors
		Lai and Cheng (2003)	Quality manager in public housing
	U.K	Hellard (1991)	construction industry
	Malaysia	Abdul -Alazi (2002)	contractors
	India	Metri (2005)	Literature review
	Australia	Sharma and Gudanne (2002)	CEO of construction industry

As shown in Table 16, this study is in agreement with studies of U.K, U.S.A, Singapore, Malaysia, India, and Australia. Also in the Chinesen companies (e.g. Lau and Tang, 2009; Lai and Cheng, 2003; Lam et al., 2008) for the large-sized public contractors and in Singaporean companies (Pheng and Teo, 2004; Abdul -Alazi, 2002; Pheng and Hong, 2005).

In Construction, quality consciously focuses all parties to the common goal of systematically identifying and meeting the customers requirements as the superordinate goal where customers requirements are increasingly complex and expectations uncertain. However, a large proportion of migrant labour may exacerbate these difficulties. So the application of quality can become difficult (Pheng and Wei, 1996).

Customer satisfaction is achieved by ensuring that drawings and specifications are communicated to the rest of the parties should there be any changes. The parties affected by the changes can then promptly adjust their information and help to reduce the amount of time wasted.

4.5.1.3 Construction Specific Factors (Codes and Standards, Constructability of Design, Drawing and Specification)

Construction specific factors were ranked as the fifth highest factor from the perspective of contractors and the fourth highest factor of architects, and the third highest factor on average. This shows that most of contractors and architects know the value of construction specific factors and use it to improve the level of quality. This really implies the awareness of the construction industry officials, associations, governments. This is in agreement with findings of (Lau and Tang, 2009; Arditi and Gunaydin, 1997; Abdel- Razek, 1998) as shown in Table 17.

Table 17. Supportive Studies of Construction Specific Factors

Factor	Country	Author	Respondents
Construction Specific Factors	United States	Arditi and Gunaydin (1997)	construction industry
	Hong Kong	Lau and Tang (2009)	contractor
	Egypt	Abedl- Razek(1998)	contractors
	Singapore	Pheng and Wei (1996)	construction industry

Finally, there is evidence that some concerns with construction specific factors should be taken to increase awareness among construction companies, since only the above studies mentioned included this factor in their frameworks.

However, companies that pursue construction specific factor will be able to reduce total quality cost and improve product quality in the long run (Arditi and Gunaydin, 1997).

Contractors and architects should investigate the source of the specified requirements, namely, the current standards and codes of practice as well as the specifications, since these may be ambiguous in certain aspects, and so difficult to conform to.

Additionally, the consensus is that, in Jordan contact with the government is basically to obtain certain permits and this is usually done at both the early and the late stage of the project which indicates awareness of the importance of construction specific factors.

In case of this survey, it can be clearly shown that there is a significant difference between architects and contractors; where architects give higher concern regarding this factor, therefore, contractors should pay more attention to construction specific factors in order to enhance quality practices, as stated in the study conducted in Singapore by (Pheng and Wei, 1996):

- The contractors pay more attention to completing the works on schedule and controlling the costs within budget than to achieving quality in construction especially if they have already met the minimum requirements for quality.

- The designers do not consider the “buildability” problems in design. Designers are sometimes unaware of the difficulties contractors experience on site.

- The contractors cannot plan and control the works. The contractors lack the skills to interpret the design and cannot provide the end products on site in accordance with the design and specifications.

- It may be more difficult to implement quality on a building site than within the organization because the other parties in the project team may resist this process.

Consequently, contractors do not realize that it is not the quality that costs but rather the nonconformance to quality that is expensive. The sources of costs associated with the non fulfillment of quality include the costs of rework, correcting errors, reacting to customer complaints, having deficient project budgets due to poor planning, and missing deadlines.

4.5.2 Lowest Three Factors

However, from the overall mean results, the lowest three factors in ascending order are resources (3.45), continuous improvement (3.46) and strategic management (3.55); similar survey results were obtained in Indian construction companies in 2005 by Metri.

4.5.2.1 Resources

Resources are the least important factor affecting quality in the Jordanian housing sector. It is viewed as the least important from the perspective of contractors. This factor also ranked as ninth of those important factors from the view point of architects.

Moreover, there is no significant difference according to the mean of the overall average of the respondents. The supported studies summarized in Table 18.

Table 18. Supportive Studies of Resources

Factor	Country	Author	Respondents
Resources	Egypt	Abdel- Razek (1998)	Contractors and consultants
	India	Metri (2005)	Construction industry
	U.K	Hellard (1991)	Construction industry

There is disagreement in our research with the study of Hellard (1991), where he stated that managers must so organize their resources of men, materials, machines, methods and money - monitoring them within the framework of the law on the one hand, and within the established customs and practices on the other – to achieve a balance and harmony through which the stated objective of the clients building can be economically achieved.

Both Metri (2005) and Abed-Razek (1998), show a little relative importance of resources factor to improve construction quality and concluded that it is a well known fact that resources are mainly a part of top management commitment and partially other factors.

4.5.2.2 Continuous Improvement

In this research, the contractors and architects appeared to agree statistically on the relative importance and ranking of the continuous improvement.

These results are in agreement with outcomes of research conducted in India by (Metri ,2005) which revealed that a continuous improvement (benchmarking, and statistical process control) are presented in very few frameworks in literature review, and they are the techniques used normally for the process improvement. In the real sense, they are not considered as important factor. They are part of the process

management. It is also in agreement with the findings of studies Hellard, Gunaydin (as cited by Arditi and Gunaydin, 1997). Hellard (1991) argued that use of statistical methods has relatively very little effect on the quality of construction projects and that the individual construction projects are unique and can eliminate the potential for any kind of statistical process control. However, there is a clear disagreement with studies summarized in Table 19.

Table 19. Supportive Studies of Continuous Improvement

Factor	Country	Author	Respondents
Continuous Improvement	United States	Haupt and Whiteman (2004)	contractors
		Arditi and Gunaydin (1997)	construction industry
		Pheng and Teo (2004)	Construction contractors
	Hong Kong	Lam et al. (2008)	large-sized public building contractors
		Lai and Cheng (2003)	Quality manager in public housing
	U.K	Oakland and Aldrdgie (1995)	Construction industry (consultant)
	Malaysia	Abdul -Alazi (2002))	Contractor and consultant
	Singapore	Pheng and Wei (1996)	Construction projects

As shown in Table 19, statistical techniques and benchmarking are the least applied tools , so it is important to underline that continuous improvement , widely used in other countries where quality was previously developed and considered as one of the most important factors affecting quality, such as U.S.A (e.g. Haupt and Whiteman, 2004; Arditi and Gunaydin, 1997) , Hong Kong (e.g. Lam et al., 2008; Lai and Cheng, 2003) ,U.K (e.g. Oakland and Aldrdgie, 1995), Malaysia (e.g. Abdul - Alazi , 2002), Singapore (e.g. Pheng and Teo, 2004; Pheng and Wei, 1996). They emphasized that continuous improvement which will yield excellence in design, and create teamwork are still not applied in Jordan in an integrated way and a little awareness

regarding this new approaches. This means that, these studies stressed the importance of "Fact – Based" management progress in quality improvement, and were making remarkable effort to measure improvements in theirs product, service, process.

Statistical methods provide problem-solving tools to the quality process. They provide the tools to identify the causes of quality problems, to communicate in a precise language that can be understood by all team members, to verify, repeat, and reproduce measurements based on data, to determine the past, present, and to a lesser degree, the future status of a work process, and to make decisions on facts that are based on data rather than the opinions and preferences of individuals. The most commonly used statistical methods quality process include histograms, cause and effect diagrams, check sheets, Pareto diagrams, graphs, control charts, and scatter diagrams (Arditi and Gunaydin ;1997) while Benchmarking is researching and observing best competitive practices of direct competitors and the high performing companies for improvement.

Quality is a continuous process of incremental improvements which gives an organization the competitive edge. It may take years to put it in place within an organization but a start could be made with fruitful short-term successes.

The Japanese were the forerunners of the concept of "kaizen" or "continuous improvement". Continuous improvement is increasingly becoming the life-blood of any quality management organization. Deming (1986) emphasized the importance of continuous improvement in his philosophy wherein he states: "Improve constantly and forever the system of production and service, to improve quality and productivity; and thus constantly decrease costs ".

4.5.2.3 Strategic Management

Strategic Management was ranked as the tenth important factor according to contractors and eleventh lowest according to architects and twelfths lowest on averages. This result is in disagreement with findings summarized in Table 20. Moreover, there is significant difference between the contractors and architects.

Table 20. Supportive Studies of Strategic Management

Factor	Country	Author	Respondents
Strategic Management	Singapore	Pheng and Hong (2005)	project manager in construction industry
	Hong Kong	Lam et al. (2008)	large-sized public building contractors
		Lai and Cheng (2003)	Quality manager in public housing

Table 20 illustrates that construction companies in Singapore, and Hong Kong regarding public housing were in fact leading other countries in the area of strategic planning; perhaps other countries can use the public sectors as a benchmark.

Strategic planning is essential for integrating quality requirements and targets improvements in the whole process and to examine how company develops and deploy strategic objectives and action plans, including short and long term planning ,collecting and analyzing data .Some immediate measures should be taken to increase awareness regarding new management approaches since they consider commitment toward quality strategies and policies that may take several years to provide “pay off” may be perceived as misdirection of resources.

4.5.3 Fishbone Diagram

The findings related to the quality factors are generated from the literature review and questionnaire analysis. The factors are analyzed from the view point of the contractors and architects combined to gain a full-understanding of quality factors' importance in the Jordanian housing sector. The Fishbone diagram illustrates the importance of these factors to the quality concept as seen in Figure 2.

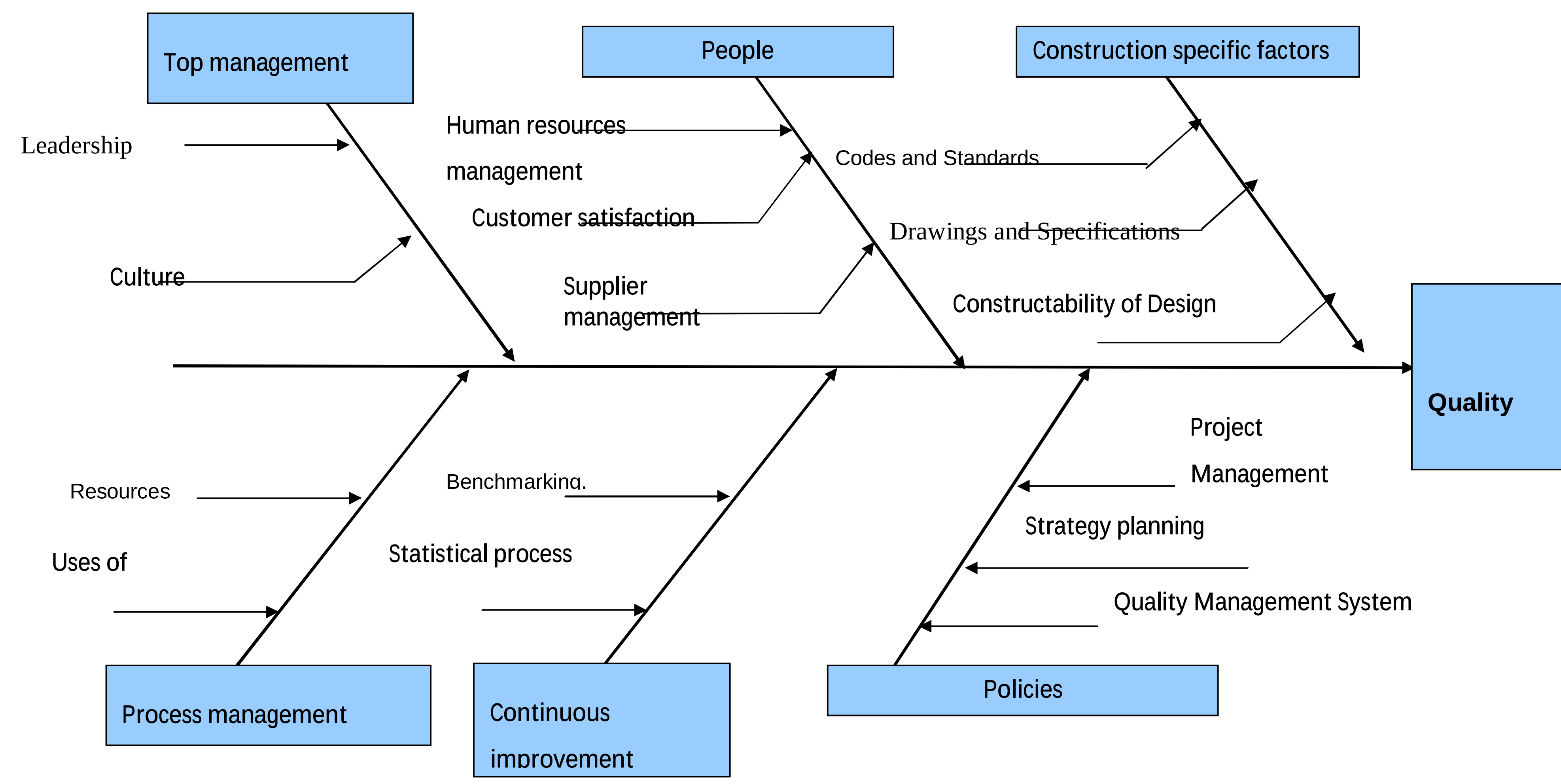


Figure 2. Fishbone Diagram for Quality Factors

CHAPTER FIVE
CONCLUSIONS, RECOMMENDATIONS, LIMITATIONS, IMPLICATIONS AND FUTURE RESEARCHES

5.1 Conclusions

The aim of this research was to identify factors that affect quality in the Jordanian housing sector, together with their relative importance. In this chapter, these factors will be summarized, and certain conclusions will be stated. Finally, this chapter shall incorporate recommendations, limitations and implications for future studies on this subject.

The concept of quality can be defined from the view point of contractors and architects combined are: how closely the project conforms to its requirements and meeting the requirements of the designer, constructor and regulatory agencies as well as the owner.

This research proposes a conceptual framework for quality factors as a contribution to the quality field, which explains the factors that is associated with business involving housing sector (Figure 3). This figure illustrates the 13 factors showing the highest and lowest factors.



Fig 3: The Proposed Framework for Quality Factors in the Housing Sector

Architects ranked the following as the highest three factors affecting quality, respectively:

- Human Resource Management
- Customer Satisfaction
- Uses of Technology

Contractors ranked the following as the highest three factors affecting quality, respectively:

- Human Resource Management

- Customer Satisfaction
- Top Management Commitment

Architects and contractors combined ranked the following as the highest significant three factors affecting quality, respectively:

- Human resources management, with no significant differences.
- Customer satisfaction with no significant differences.
- Construction specific factors with a significant difference.

Architects and contractors combined ranked the following as the lowest significant three factors affecting quality, in ascending order:

- Strategic planning with significant difference.
- Continuous improvement with no significant differences.
- Resources with no significant difference.

5.2 Recommendations

Recommendations for practice emerge from this research. The research findings identify implications for managers in construction industry (e.g. contractors, architects and owners) and policy makers (e.g. Jordanian government). This research indicates that future strategies and potential developments should be based on the following findings for developing quality in the Jordanian housing sector:

- Human Resources Management

*** Team Work**

1. Team-working, with the client as part of the team in a genuine partnership to achieve project objectives.

2. Use non-hierarchical (flat) organizational structures (e.g. councils, quality circles, steering committees and quality improvement teams, cross-functional working teams) to support quality improvement and facilitate information flows and create an environment for teamwork.

*** Involvement**

1. Contractors, suppliers, subcontractors, designers, project managers and, above all, the client - the customer whom the entire industry exists to serve – must be involved in the process.
2. Encourage and maintain active employee involvement.

*** Education and Training**

1. Generate awareness, by utilizing compulsory "awareness seminars" that draw people from different levels to focus on concept of quality.

2. Educate project staff and change attitude to encourage involvement and continuous improvement through both the programmes as well as educational institutions.

3. Increasing contractors' technical and managerial efficiency.

4. The training effort may include instruction in the basics of quality, cause-and-effect analysis, team problem solving, interpersonal communication and interaction, statistical methods, quality concepts.

5. Follow-up training is essential, and is part of the overall training plan and a job requirement for each individual..

- Customer Satisfaction

1. Evaluates customer satisfaction with internal performance objectives (e.g., by comparisons with past customer satisfaction index or standard set (measure of repeat customers).

2. Involvement of customers (customer feedback forms, survey to assess the level of customer satisfaction for each project).

- Construction Specific Factors

1. Standards, drawing, specifications must be established before detailing in the form of contract and before performing the tasks.
2. The contractors should pay more attention in achieving quality in construction than completing the works on schedule.
3. The designers should consider the “buildability” problems in design.

4. Participating with international construction organizations.

5. Meeting the requirements of regulatory agencies (the public) as public safety and health; environmental considerations; protection of public property including utilities; and conformance with applicable laws, regulations, codes and standards.

- Resources

1. The materials chosen by the consultants should satisfy the standards or the Building Control Authority.

2. Contractors should organize their resources of men, materials, machines, methods, money.

- Strategic Planning

1. Prepare project quality plans for all levels of work and schedule especially during the pre-construction phase.

2. Review quality plans and measure performance and corporate policy following new quality awareness.

3. Prepare strategic human resources management (e.g., education, training, and employee involvement schemes) is a key performance objective.

4. Implements long-term plans (3 years or more) which are based on customer needs and company capabilities.

- Continuous Improvement

1. Learn from the experience of the top performers in the service and public utilities sectors.

2. Benchmarking of direct competitors and the high performing companies for improvement.

3. There should be feedback loops originating at the end of each phase which could be used to upgrade the original quality standards adopted at the beginning by using Statistical analysis

4. Look for root causes when diagnosing the system.

5.3 Research Limitations and Areas for Future Research

The subject area of the empirical research, based on exploratory study on quality for the housing sector, provides a promising first step towards a greater understanding of the relative importance for quality factors. Nonetheless, there are some limitations of this study which should be acknowledged when interpreting the findings in order to provide opportunities for improvement in future research. This study was limited in several aspects:

- The survey findings are only based on the view points of contractors and architects. The study findings would be improved if the research used more respondent types such as owners of construction projects and policy makers. Future research should expand the research to other types of projects such as public projects. Carrying out a study depending on a larger number of

companies in Jordan, and focusing on all companies sizes (small, medium and large). This allows the researchers to compare the impact between the different sizes. Moreover, We targeted a single-well informed respondent from each sampled company, as the success of quality management implementation demands an organization wide focus.

- The study would be improved if multi-methods, especially extensive semi-structured interviews within the exploratory study in a future study. It is important in future research to use other methodologies such as case studies (single or multi-case types). In the meantime, although the data collection is very costly and requires personal meetings and having the right space and time, a future longitudinal study to examine the relative importance of quality factors would end with more integrated findings.
- Future research would be better if it can include more quality factors such as project management, risk management, maintenance management and other important human resource management elements (e.g. empowerment). Other studies would bring better findings if they use Taughchi model for research method and analysis.
- Due to the time and resource constraints, only a limited number of samples were collected focusing on major companies and general managers. Therefore, the key findings might differ if a future empirical study considered small companies and multi-level of respondents.
- In order to generalize the proposed framework to the construction industry in Jordan and other industries and countries, further empirical research will need to involve data collection from diverse industries and countries. Nonetheless, Jordan's experiences in quality in housing sector will be

applicable to other Middle East countries, where comparison studies could provide support for the conceptual framework of quality factors. Study quality factors in different cultures and social contexts will not only help to generalize the findings but also contribute to determining how differences in cultural and social context influence quality.

5.4 Research Implications

- The construction companies do have to catch up with their own weak factors in order to maintain a balanced and integrated quality approach especially with continuous improvement since statistical methods are very important in monitoring quality, and strategic planning.
- Many construction contractors in the U.S.A, Singapore, and U.K have used quality successfully for a number of years as assured by Culp (as cited in Lam et al., 2008), so it is recommended to follow these countries experience in dealing with quality.
- The implementation of quality should not be seen as something additional to what (contractors and architects) do, but rather as a form of process control that needs to be applied to the existing process.
- Construction organizations should realize that results cannot be gained overnight and that an organization needs time to adapt, change, and learn. However, the biggest hurdle for the organization is to change and to develop a culture that will support quality.

Consequently, contractors do not realize that it is not the quality that costs but rather the non-conformance to quality that is expensive. The sources of costs associated

with the non fulfilment of quality include the costs of rework, correcting errors, reacting to customer complaints, having deficient project budgets due to poor planning, and missing.

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Appendix A



University of Jordan

Identifying the Relative Importance of Factors Affecting Quality in the Jordanian Housing Sector

Dear respondent

Thank you for participating.

This paper is primarily to identifying factors affecting quality in the housing sector in Jordan and their relative importance. The results will help me in completion my master thesis at the University of Jordan.

Please be assured that your responses will be kept strictly confidential. Individual participants will not be identified in the analysis as only aggregated results will be analyzed and presented. The results will be used for research purpose only and no attempt will be made to identify any individual or organizations in any publication.

The success of this survey depends on your participation and frank responses. Hence, I would greatly appreciate your assistance in answering the questionnaire. If you would like to receive a copy of our findings, please fill the following:

Name:
Email:
Mobile:
Mail Address:

Note: The questionnaire should be filled in by those persons who are in charge of quality.

Instructions: This questionnaire consists of two main sections. Please read the questions carefully before answering. Where appropriate, circle.

Section 1: Demographic Characteristics
In the section below, please tick (√) the appropriate choice about you
Gender
☐ male
☐ female
Age
☐ 20-30
☐ 31-40
☐ 41-50
☐ over 50
Education
☐ high school
☐ diploma
☐ bachelor
☐ higher education
Experience
☐ 1-5
☐ 6-10
☐ 11-15
☐ over 15

Section 2: Quality Factors					
In this section, we are trying to determine factors affecting quality in the Jordanian housing sector. Please circle the number that you feel most appropriate for each factor. Please use the following scale :1= totally disagree, 2= generally disagree, 3= somewhat agree, 4= generally agree, 5= totally agree					
Top Management Commitment	**1**	**2**	**3**	**4**	**5**
Leadership	**1**	**2**	**3**	**4**	**5**
Culture	**1**	**2**	**3**	**4**	**5**
Customer Satisfaction	**1**	**2**	**3**	**4**	**5**
Resources	**1**	**2**	**3**	**4**	**5**
Quality management systems	**1**	**2**	**3**	**4**	**5**
Continuous Improvement					
• **Benchmarking**	**1**	**2**	**3**	**4**	**5**
• **Statistical Process Contr**	**1**	**2**	**3**	**4**	**5**
Strategic Management	**1**	**2**	**3**	**4**	**5**
Process Management	**1**	**2**	**3**	**4**	**5**
Supplier Management	**1**	**2**	**3**	**4**	**5**
Uses of Technology	**1**	**2**	**3**	**4**	**5**
Construction Specific Factors					
• **Codes and Standards**	**1**	**2**	**3**	**4**	**5**
• **Drawing and Specification**	**1**	**2**	**3**	**4**	**5**

• **Constructability of Design**	**1**	**2**	**3**	**4**	**5**
Human Resource Management					
• **Education and Training**	**1**	**2**	**3**	**4**	**5**
• **Involvement**	**1**	**2**	**3**	**4**	**5**
• **Teamwork**	**1**	**2**	**3**	**4**	**5**

Thank you

تحديد الأهمية النسبية للعوامل المؤثرة على جودة القطاع الإسكانـــي الأردنـــي

إعداد

لانا عيد جريسات

إشراف

د.راتب جليل صويص

ملخـــــــــــص

تهدف هذه الدراسة إلى دراسة العوامل المؤثرة على جودة القطاع الإسكانـــــي الأردنـــــي وتحديد هذه العوامل من وجهة نظر المقاولين والمصممين معاً وأي هذه العوامل تؤثر بشكل أكثـــر على جودة القطاع الإسكاني.

ولتحقيق ذلك، تم استخدام الطريقة المسحية . حيث أن أولا تم تحديد ١٣ عاملا مـــن خـــلال تحليل الأبحاث السابقة ثم تم تصميم استبانه وتم توزيعها باليد ومن خلال مقابلة شخصية مـــن قبـــل الباحث على ٢٤٣ شركة مقاولات و٨٥ مكتب هندسي واستشاري خلال شهرين.وبعد ذلك، حللـــت الاستبيانات .

بينت نتائج تحليل البيانات إحصائياً أن أكثر العوامل المؤثرة من وجهة نظر المقاولين والمـــصممين معا هي إدارة الموارد البشرية ورضا الزبائن والعوامل الخاصة بالقطاع الإنشائي من بين ١٣ عامل تم دراستهم وهم (الموارد البشرية، التزام الإدارة العليا، التخطيط الاستراتيجي، الحضارة، الموارد، استخدام التكنولوجيا،....) وأن اقل العوامل تأثيراً هي التخطيط الاســـتراتيجي، التطـــوير المـــستمر والموارد.

هذه الدراسة تساهم في اقتراح نموذج نظري مكون من ١٣ عامل يـؤثرون علـى جـودة القطـاع الإسكاني الأردني.

بناء على النتائج السابقة، نوصي القطاع الإسكانـي الأردنـي الاهتمام بالموارد البشرية مـن حيث التدريب والتعليم والمشاركة والعمل الجماعي والاهتمام برضا الزبائن من حيث تحقيق جميـع متطلباته والاهتمام بالعوامل الخاصة بالقطاع الإنشائي وهـي الكـودات والتـصاميم والرسـومات الهندسية والمعايير وقابلية التصميم للتنفيذ وذلك من أجل النهوض بالقطاع الإسكانـي الأردنـي والحصول على جودته.